Independent Assessment Review

High Performance Computing & Communications Program

System Software Integration Management Team Overview

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NASA Ames Research Center

System S/W Integration Management Team Members

- **Jerry Yan** (Team Manager)
  CAS, NASA Ames Research Center

- **Roger Lee**
  REE, Jet Propulsion Laboratory

- **Alan Federman**
  LT, Raytheon @ NASA Ames Research Center

- **Mark Foster**
  NREN, Recom @ NASA Ames Research Center

- **Phil Merkey**
  ESS, Michigan Tech.

- **Dave Rudy**
  CAS, NASA Langley Research Center

- **Greg Follen**
  CAS, NASA Glenn Research Center

System Software Integration Management Team Charter

1) **Maintain a current knowledge of** national and international high performance computing and communication **system S/W activities**, including key emerging technical trends and technologies.

2) **On an annual basis, complete a NASA System S/W Technical Review** covering system S/W activities within the NASA HPCC Program, leading to a written report delivered to the NASA HPCC Program Office.

3) **On an annual basis,** beginning in the fall of 2000, support the HPCC Program Office and the HPCC Project Managers in the updating of the HPCC Program and Project Plans to address the issues identified in the HPCC Program System S/W Technical Review. Specifically, **work closely with the HPCC Project Mangers to update each Project Plan** to allow the System S/W Integration Manager to concur that each Project Plan is contributing to an effective overall application activity.

4) On a need basis, bring to the attention of NASA HPCC Program and Project Management system S/W issues that, if addressed, can **improve the effectiveness of the NASA HPCC Program.**

HPCC System Software Catalog

- **We need to <u>define</u> HPCC System S/W**
  - **"S/W that bridges the gap between applications and testbed"**

- **We need to <u>gather</u> and maintain this information**
  - **Build a web-based catalog for information about all HPCC system S/W**
  - **Ensure that the current and future HPCC system S/W are represented in the catalog**

- **We need to <u>categorize</u> various projects**
  - **Examples include: parallelization tools, problem solving environments/frameworks, fault tolerance tools**

CAS System S/W

- **Framework to support Multidisciplinary Design Optimization (MDO) applications**

- **Numerical Propulsion System Simulation (NPSS)**
  - **A S/W architecture built upon CORBA designed for modeling aeropropulsion engine systems.**

- **Arcade: A Web based framework for distributed applications**
  - **Provide support for discipline experts to collaboratively design, execute and monitor multidisciplinary applications**
  - **Evaluate and assess the various programming languages (extensions) such as OpenMP, HPF and JAVA for high performance computing**

- **CAPO: Tool-set for automatic parallelization of FORTRAN Program via OpenMP**

- **Charon: Programming tool for incremental parallelization of sequential code**

- **Performance monitoring tools**
  - **A shared infrastructure for information collection, broadcast and subscription for the testbed to support performance tuning, fault tolerance and scheduling.**

- **P2D2: Parallel debugger for parallel/distributed programs**

- **iLAB: Parameter study tool-set**
  - **Automatic generation and management of computations for complex multi-dimensional multi-stage parameter studies**

ESS System S/W

- **PARAMESH:**
  - PARAMESH is a package that makes it easy to extend an existing serial code which uses a logical Cartesian structured mesh into a parallel code with adaptive mesh refinement (AMR).

- **Parallel Virtual File System (PVFS):**
  - PVFS was developed at Clemson University with support and collaboration from ESS

- **Repository in a Box (RIB):**
  - RIB is a software package for creating WWW meta-data repositories

- **GODdard Instrumentation Visualizer and Analyzer (GODIVA):**
  - GODIVA is a software instrumentation package which allows real application codes to be used more effectively as performance benchmarks in the evaluation of large-scale parallel computers.

- **Beowulf system software:**
  - includes network support, system integration tools and mechanism that provides a distributed PID space on a cluster

- **TASC:**
  - TASC will work with ESS to develop an OO framework for Round-3 CAN. They are currently involved in reviewing existing modeling activities.

REE System S/W

- **Focussed on recovery from hardware faults in parallel systems in space environments via software techniques. They include:**
  - **The use of a software fault injector on the REE testbed to simulate the effect of radiation faults in a distributed architecture.**
  - **Funding the port of a software replication and voting system developed by General Dynamics to the REE testbed.**
  - **Funding the development of Chameleon, a fault tolerance system developed at University of Illinois.**
  - **Investigating the use of algorithms which can detect faults in their operation.**
  - **Possibility of developing a fault tolerant version of MPI**
- **Interested in any emerging standards in operating systems, programming models, and parallel tools.**

LT System S/W

- **Limited work in System S/W**

NREN System S/W

- **Funded research at universities include:**
  - **Middleware development for establishing access to Quality of Service capabilities in the operating system and distributed resources.**
  - **Protocol development to improve IP/ATM satellite communications**
  - **Security and policy management support**
- **Limited ongoing development work done directly by NREN staff**
  - **one exception is a project for doing passive monitoring of data flows, in support of preferred traffic (e.g., Telepresence and Remote Operation).**

Schedule

HPCC
NASA

- **June/00 - Website for catalog up**
- **July/00 - Detailed testbed investigation**
- **August/00 - Evaluate for synergy**
- **September/00 - Report due**

Summary

- **The SSIM Team began working in December 1999**

- **We decided that compiling a catalog of all ongoing work must precede the actual evaluation/comparison**
  - **The on-line catalog is almost complete**
  - **Some common areas among projects has been identified**
    - For example: CAS and REE develop system S/W for both their science value as well as to test hardware and system software
  - **Definition of system S/W is still open for discussion in some cases**
    - For example: frameworks can be "applications" in one center/project and system S/W in another
    - Coordination with other integration team will ensure no tasks "slipped between the crack"
  - **The SSIM Team will use this catalog to meet the requirements of its charter**

- **Categorization for various projects will continue**